IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of

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Corres. to PCT/EP2004/012695

For: HEAT EXCHANGER, ESPECIALLY CHARGE-AIR/COOLANT COOLER

TRANSLATOR'S DECLARATION

Commissioner for Patents
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Sir:

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I further declare that all statements made in this declaration of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful, false statements may jeopardize the validity of legal decisions of any nature based on them.

Date: April 26, 2006

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**Heat exchanger, in particular charge-air/coolant radiator**

The invention relates to a heat exchanger, in particular a charge-air/coolant radiator, with a disk structure according to the preamble of claim 1.

In conventional charge-air/coolant radiators with a disk structure, the charge air and the coolant are introduced into the coolant disks via in each case one individual pipe stub. A charge-air/coolant radiator of said type leaves something to be desired, in particular with regard to cooling performance.

It is an object of the invention to provide an improved heat exchanger.

Said object is achieved by means of a heat exchanger having the features of claim 1. Advantageous embodiments are the subject matter of the subclaims.

According to the invention, a heat exchanger, in particular a charge-air/coolant radiator, with a disk structure is provided, having a plurality of disks, two adjacent disks defining an intermediate space through which a heat transfer medium flows, and having in each case one heat transfer medium inlet and heat transfer medium outlet which are common to the disks, at least two heat transfer medium ducts being provided per heat transfer medium inlet and/or outlet. Here, the heat transfer medium ducts are preferably formed by apertures, which are in particular aligned with one another, in the individual disks.

Any other desired correspondingly constructed heat exchanger, for example an oil cooler, can be used

instead of a charge-air/coolant radiator. A heat exchanger of said type which is embodied according to the invention permits good distribution of the heat transfer medium over the heat-exchanging faces of the individual disks which form the heat exchanger. The uniform flow distribution reduces the problem of boiling in heat exchangers used in regions which are critical in this regard.

The distribution of the heat transfer medium is assisted by means of an axially symmetrical configuration of the disks, based on their longitudinal axis, with regard to the heat transfer medium ducts. Assembly is simplified if the disks are also designed to be axially symmetrical relative to their transverse axis.

One individual heat transfer medium inlet and/or one individual heat transfer medium outlet which has a branching section and/or converging section is preferably provided. This makes a relatively simple design possible with improved heat transfer on account of the better flow distribution.

The branching section and/or the converging section are preferably designed in the form of an arc of a circle, so that a space-saving construction is possible around the bolts or the like which hold the individual disks together.

A bend of 30° to 90° - as seen in the flow direction - is preferably provided in the region of the branching section and/or converging section, the forked part of the branching section and/or converging section being aligned parallel to the disks.

The heat transfer medium inlet which merges into two

heat transfer medium ducts after the branching section preferably runs parallel to the heat transfer medium ducts, while the bipartite part of the branching section is preferably arranged in a plane which is perpendicular to said heat transfer medium ducts. The heat transfer medium outlet which merges from two heat transfer medium ducts into the converging section preferably runs parallel to the heat transfer medium ducts, while the bipartite part of the branching section is preferably arranged in a plane which is perpendicular to said heat transfer medium ducts. This makes a compact and space-saving design of the heat exchanger possible. Alternatively, the supply can also take place by means of two individual, separately embodied tubes which are connected to one another by means of a Y-shaped connecting piece.

A heat exchanger of said type is preferably used as a charge-air/coolant radiator for cooling the charge air. A mixture of water and glycol is preferably used here as the heat transfer medium (coolant).

The invention is explained in detail in the following on the basis of an exemplary embodiment and with reference to the drawing, in which:

Fig. 1 shows a schematized perspective exploded illustration of a charge-air/coolant radiator with a disk structure according to the exemplary embodiment,

Fig. 2 shows a perspective illustration of the charge-air/coolant radiator of figure 1,

Fig. 3 shows a section through the charge-air/coolant radiator of fig. 1 along the line III-III in fig. 4, and

Fig. 4 shows a section through the charge-air/coolant radiator of fig. 1 along the line IV-IV in fig. 3.

A charge-air/coolant radiator 1 which serves as a heat exchanger between charge air and coolant has a plurality of coolant disks 2 which are stacked on top of one another. Here, two inlet openings 3 and two outlet openings 4, through which coolant as a heat transfer medium is respectively fed into and discharged from the intermediate spaces between the coolant disks 2, are provided in each case in each coolant disk 2. The flow direction is indicated in the figures by arrows. Here, after entering through the inlet openings 3, the coolant is distributed over the entire width of the intermediate spaces between the coolant disks 2 and flows uniformly in the direction of the outlet openings 4 (see figure 3), so that flow passes uniformly through the entire length and width of the intermediate spaces between the inlet and outlet openings 3 and 4, and an optimum transfer of heat is possible from the charge air to be cooled which flows through the charge-air/coolant radiator 1 between the individual coolant disks 2.

The openings 3 and 4 of the coolant disks 2 which are stacked on top of one another form coolant ducts 5 and 6. For this purpose, the regions of the openings 3 and 4 are of correspondingly raised design, so that sufficient intermediate space is present such that the charge air can flow through and be cooled between the coolant disks 2.

The two coolant ducts 5 begin - as seen in the flow direction of the coolant - at a branching section 7 which has a bifurcation 8 in the shape of an arc of a

circle and a coolant inlet 9 which is arranged centrally in the arc of said bifurcation 8 and is arranged parallel to the coolant ducts 5. The coolant which is fed through the coolant inlet 9 is thus distributed uniformly between the two coolant ducts 5.

The outlet is designed in a corresponding manner to the inlet. The two coolant ducts 6 thus end with a converging section 10 which is designed in a corresponding manner to the branching section 7 and has a coolant outlet 11.

## List of reference designations

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| 1 | Charge-air/coolant radiator |
| 2 | Coolant disk |
| 3 | Inlet opening |
| 4 | Outlet opening |
| 5 | Coolant duct |
| 6 | Coolant duct |
| 7 | Branching section |
| 8 | Bifurcation |
| 9 | Coolant inlet |
| 10 | Converging section |
| 11 | Coolant outlet |